

CLAIMS

1. A method of forming an annular rolled reinforcing rib between a central panel and a chuckwall of an end shell in a single stroke and at a single station of a double action press prior to the removal of the shell from the press, comprising the steps of:

blanking and drawing a disc blank having a central panel and an outer flange by wiping the periphery of the disc blank over an inner die core ring;

forming a chuckwall by advancing a punch core and clamping a portion of the central panel against a die core;

clamping a portion of the chuckwall between an inner pressure sleeve and the die core ring;

providing an annular void between the punch core and die core ring when the punch core clamps the central panel against the die core;

forming the rolled reinforcing rib from an unclamped portion of the chuckwall within the annular void by advancing the inner and outer pressure sleeves while maintaining clamping engagement of the central panel between the punch core and die core, and between the inner pressure sleeve and die core ring; and

releasing said clamping engagement substantially simultaneously between the punch core and die core and between the inner pressure sleeve and die core ring after forming the reinforcing rib.

2. The method defined in claim 1 including the steps of:

providing an inner ram;

mounting the punch core on the inner ram;

applying a fluid pressure to the punch core for clamping the central panel

5 between the punch core and die core; and

continuing to advance the inner ram after the die core has clamped the central panel between the punch core and die core by overcoming said fluid pressure to provide a dwell time for said punch core in clamping engagement with said central panel.

10

3. The method defined in claim 2 including the step of:

providing the dwell time for approximately 25° of the inner ram movement.

4. The method defined in claim 3 including the steps of:

15 providing an outer ram;

mounting the inner and outer pressure sleeves on the outer ram; and

moving the inner ram in advance of the outer ram for clamping the central panel and chuckwall before forming the rolled reinforcing rib.

20 5. The method defined in claim 1 including the step of mounting the die core in a fixed position of the base.

6. The method defined in claim 1 including the step of providing the inner pressure sleeve with a contoured end having an angled surface portion and a concave surface portion.

5 7. The method defined in claim 1 including the step of reaching bottom-dead-center of the inner ram stroke approximately 25° before reaching bottom-dead-center of the outer ram stroke.

10 8. The method defined in claim 1 including the step of discharging the shell from the press by applying a jet of pressurized air against said shell.

15 9. A method of forming an annular rolled reinforcing rib between a central panel and a chuckwall of an end shell in a single stroke and at a single station of a double action press prior to the removal of the shell from the press, comprising the steps of:

blanking and drawing a disc blank having a central panel and an outer flange;

forming an elongated chuckwall between the central panel and outer flange;

20 clamping the central panel against a die core;

clamping a portion of the chuckwall between a pressure sleeve and a die core ring;

providing an annular void between the punch core and a die core ring
when a punch core clamps the central panel against the die core;

forming the rolled reinforcing rib from an unclamped portion of the
chuckwall within the annular void by advancing the pressure sleeve while
maintaining clamping engagement of the central panel between the punch core
and die core, and between the pressure sleeve and die core ring; and

releasing said clamping engagement substantially simultaneously
between the punch core and die core and between the pressure sleeve and die
core ring after forming the reinforcing rib.

10. The method defined in claim 9 including the steps of providing inner and
outer rams;

advancing the inner ram to clamp the control panel against the die core;

advancing the outer ram to clamp the outer flange between the pressure
sleeve and die core ring;

reaching a bottom-dead-center position in the stroke of inner ram before
forming the rolled reinforcing rib upon advancement of the outer ram to a
bottom-dead-center position; and

maintaining the inner ram at its bottom-dead-center position while said
outer ram moves to its bottom-dead-center position.

11. In a double action press having inner and outer rams and an opposed base and apparatus for forming an end shell of a container from a sheet metal blank, wherein the end shell has a rolled annular reinforcing rib, said apparatus comprising:

- 5 a) a punch core carried by the inner ram and a die core mounted on the base in opposed relationship therewith;
- b) inner and outer pressure sleeves carried by the outer ram and a movable die core ring carried by the base in opposed relationship therewith;
- c) said outer pressure sleeve releasably holding an outer flange of the
10 blank against the die core ring as the die core draws material over the die core ring to form a chuckwall extending between said outer flange and a central panel;
- d) said inner pressure sleeve being movable into clamping engagement with and holding a portion of the chuckwall adjacent the outer flange against the
15 die core ring leaving an unclamped portion of the chuckwall extending between the central panel and clamped portion of said chuckwall;
- e) said inner and outer pressure sleeves being movable toward the base while maintaining clamping engagement of the chuckwall and the outer flange against the inner die core ring to roll the unclamped portion of the chuckwall into
20 the rolled reinforcing rib; and

f) said punch core and inner and outer pressure sleeves being simultaneously movably out of clamping engagement with the central panel, chuckwall, and outer flange to retain the shape of the rolled reinforcing rib.

5 12. The apparatus defined in claim 11 including:

 a timing control for moving the punch core into clamping engagement with the central panel prior to moving the pressure sleeves into clamping engagement with the chuckwall and outer flange.

10 13. The apparatus defined in claim 12 including a punch core riser attached to the punch core;

 a fluid pressure cylinder mounted on the inner ram; and

 a fluid actuated piston located within the cylinder and operatively connected to the punch core riser for controlling movement of the punch core
15 until the inner ram reaches a bottom-dead-center position.

14. The apparatus defined in claim 11 including a punch shell carried by the outer ram.

20 15. Apparatus for forming a container end panel having a central panel, an outer flange and chuckwall, and a rolled reinforcement rib interconnecting said chuckwall and central panel, comprising:

a punch core;

inner and outer pressure sleeves disposed in concentric relationship with said punch core;

a punch shell disposed in concentric relationship with said inner and outer pressure sleeves;

a die core disposed in opposed relationship with said punch core;

a movable die core ring disposed in opposed relationship with said inner and outer pressure sleeves;

a lower pressure sleeve in opposed relationship with said punch shell;

and

a timing control which simultaneously retracts said punch core and said inner and outer pressure sleeves with respect to said punch core and die core ring after said punch core and said inner and outer pressure sleeves have reached a bottom-dead-center position.

16. The apparatus defined in claim 15 including inner and outer rams, said punch core being carried by the inner ram, and said inner and outer pressure sleeves and punch shell being carried by the outer ram.

17. The apparatus defined in claim 15 wherein the die core ring is radially spaced from the punch core when said punch core extends into said die core ring.

18. The apparatus defined in claim 17 wherein the die core ring has a profiled end with a convexly curved outer end surface and an angled surface; in which the outer pressure ring has an end surface complementary to said convexly curved surface and is in opposed relationship therewith; and in which the inner pressure sleeve has an angled end surface complementary to and in opposed relationship to the angled surface of said die core ring.

19. The apparatus defined in claim 18 wherein the inner pressure sleeve has a curved surface adjacent the angled surface thereof; and in which said curved surface extends into the spaced formed between the punch core and die core ring.

20. The apparatus defined in claim 16 wherein the punch core is fluidly supported on the inner ram.

21. The apparatus defined in claim 15 wherein the die core is fixedly mounted on a base.

22. The apparatus defined in claim 16 wherein the timing control controls the stroke of the inner and outer rams; and in which the inner ram leads the outer ram.

23. The apparatus defined in claim 22 wherein the inner ram leads the outer ram by a phase angle of approximately 25° .